

SCIENCE

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NEW YORK, MARCH 23, 1894.

THE IMPORTANCE OF STRUCTURAL DETAILS IN THE STUDY OF PLANTS.

BY W. W. ROWLEE, ITHACA, N. Y.

If there was any one thing more than another that led the ancient herbalists into serious and often amusing errors in regard to plants, it was their ignorance of the structure of vegetable tissues. Their minds were not in a condition to be attracted by natural phenomena, and, further, they were without lenses and other appliances which are so indispensable as aids to workers of the present day.

It is, moreover, but recently that some important advances have been made in methods of treating tissues in order that their structure may be more thoroughly and exactly studied. With the exception of those which are lignified or sclerenchymatous, all vegetable tissues are too soft and yielding to be cut even with the sharpest knife without undergoing displacement and distortion, and especially is this true of that part of the tissue most important of all from a physiological point of view, i. e., the protoplasm. In its normal condition in the vegetable cell, protoplasm resembles in texture and consistency the white of an egg. No one would expect to cut this substance in its natural condition into sections to be examined with a microscope. The cell-walls also are displaced when unfixed tissue is cut, especially if the tissue be from delicate organs. If fresh material could be cut and examined without any distortion it would be highly desirable to do so, as all parts would be unchanged, but not only is this impracticable on account of the firmness of the tissue, but, moreover, certain parts are in nature colorless and must be stained before they can be seen.

Fixation of tissues consists in hardening and preserving the pliable and perishable parts of tissues, especially protoplasm and its primary modifications. This is accomplished by replacing the water in the tissue by some preserving fluid. The tissue must be killed immediately,

and the elements must remain *in situ* through the process of infiltration if the fixing is properly done. Professor Gage in his "Histology" recommends picric-alcohol (25 p. c. alcohol + .2 p. c. picric acid) for fixing tissues, and it has given us entire satisfaction so far as fixing material is concerned. The stain made by picric acid, however, is not altogether satisfactory. Professor Campbell (*Bot. Gaz.* Feb., 1891) found chromic acid very effective as a fixing agent in his work upon the delicate tissues of fern prothallia. We have been satisfied with results attained from using alcohol, always being careful at first to apply only sufficient to kill the tissue and then gradually to increase the strength of alcohol until the tissue is completely dehydrated. The most satisfactory method of accomplishing this we have found is by the modification of Schultze's apparatus devised and described by Professor Thomas (*Proc. Am. Micro. Soc.*, 1890). If the fixing has been properly done all the tissue elements will be *in situ* and normal except in so far as the alcohol produces changes. The tissue after fixing has been accomplished instead of being flexible is exceedingly brittle and must during succeeding manipulations be handled with the greatest care. As a general rule it is safer to pour pieces of delicate tissue from one vessel to another rather than to handle them with forceps. In this condition, protoplasm and cell-walls are firm enough to withstand the knife without displacement, providing proper support is afforded.

This support may be gotten by infiltrating the tissue with some liquid which under changed conditions will become solid. Here, too, the agents used should be such as modify the tissue as little as possible. Paraffin and collodion have been most used. Both will penetrate not only the intercellular spaces and cell cavities but will also infiltrate into the cell-walls and protoplasm, preventing the former from tearing and holding the nucleus and plastic bodies of the latter in position during sectioning. The effects of alcohol and other reagents upon tissues should be determined carefully by experiment, and such changes as occur should be considered before conclusions are drawn.

The importance of exactness in structural studies can scarcely be over-estimated. Confirmation or modification of new systems of classification (and there are plenty of them at the present time) must depend for their permanency quite as much upon accurate observation of structural details as upon the ingenuity of any systematist. A single illustration from a discovery made in our laboratory may not be inappropriate. The nodding bidens (*Bidens cernua*) differs from its congeners of the northeastern United States in having the hypocotyl of the embryo in the seed before germination possessed of large and numerous intercellular spaces. The occurrence of large intercellular spaces in an embryo is of comparatively rare occurrence and is probably of assistance to the plant in aerating its tissues during germination. This seems the more probable when one considers that the first structural modification attending germination is the enlargement of the intercellular spaces. In species in question the provision of intercellular spaces has been provided before germination. If this organ had been cut fresh the knife would have displaced the cells so as to render uncertain the relation of the cells and spaces.

Fixed and properly imbedded, the cells retain their normal condition and position; the intercellular spaces are just as they were in the living plant.

The embryos of other plants afford quite as distinctive structural characters and often as interesting functional adaptations.

The correct interpretation of tissue modifications in plants has led to the conclusion that plant diseases may be caused by improper conditions of moisture, etc. Dropsy in plants has been caused by too great activity in the root-system of the plant, and thereby unbalancing the equilibrium between absorption and transpiration. This disease was first discovered by a careful examination of the structural details, and the fact that the disease was so discovered leads to the opinion that much light may be thrown upon the diagnosis and cure of plant diseases by a careful study of the minute structure of the plant.

NATIONAL PARK PROTECTION.

BY GEO. BIRD GRINNELL.

THE recent slaughter of twenty or more of the National Park buffalo has excited widespread comment and calls attention anew to the fact that, although the Yellowstone Park was established twenty-two years ago last March, no law for its protection has ever been enacted.

The organic act by which the Park was set aside says that the Secretary of the Interior shall make rules and regulations for its protection and the preservation of its natural wonders, but nothing in this act nor in any other provides any form of government, gives jurisdiction to any court, appoints any law officers or defines and fixes penalties for any crimes or misdemeanors committed within the boundaries of the reservation.

There are now pending before Congress—in the House of Representatives and in the Senate as well—several bills which provide for the cutting off from the area of the Park about 1,200,000 acres of land, largely forest covered, and one or two which contain some needed government and police provisions. It is of the utmost importance that one of these last named bills should be passed. No matter how efficient and energetic the commander and his troops, to whom the care of the Park has been given, it is impossible for him efficiently to protect it so long as no punishment awaits the man who violates the regulations established by the Secretary—shoots down the buffalo or fires the forests. As things exist to-day no such punishment can be meted out. Government scouts may capture a poacher red-handed, having just slain some of America's largest wild animals, but it is certain that soon after the prisoner has been brought to the guard house, he will be set free, because no law takes cognizance of his crime and provides that he shall be given a trial and punished if found guilty. The Yellowstone Park has been set apart from the states in which it lies, and put under the authority of the Secretary of the Interior. The laws of those states, therefore, do not apply to crimes committed within its borders, and Congress has given the Secretary of the Interior no authority to punish crime.

No class of men comprehend better than the readers of *Science* the importance of preserving the Yellowstone Park and all it contains as nearly as possible in a state of nature. Nor is there any class among our population who can exercise more influence toward inducing Congress to pass the much needed laws. It is earnestly to be hoped that each reader of *Science* will do his part toward bringing influence to bear on Congressmen and

Senators, so that a proper police bill may be passed for the Park.

Some of the objections to the passage of the segregation bill are that such segregation would establish a very bad precedent, since if one corner can be cut off to-day another may be cut off to-morrow, and by continual whittling the area of the Park may finally be reduced to nothing. Segregation by reducing the area of the Park brings skin hunters nearer to the herds of wild game and to the forests, and increases the danger to both. Segregation also absolutely destroys large herds of wild game and considerable areas of forests at present existing in the country proposed to be segregated. Segregation reduces the area of the National Park by nearly 1,200,000 acres, restoring to the public domain land which is utterly valueless for purposes of settlement. It is high, rough, mountain land, unfit for agriculture or stock range, overgrown with timber which is at present too far from a market to be of value, and probably without any mineral deposits that are worth working. This land will be vastly more useful as a forest reserve than it can be for any other purpose.

THE SEMBLING OF A LARGE NATIVE MOTH, *TELEA POLYPHEMUS*.

BY H. GARMAN, LEXINGTON, KY.

THE collection of males of our larger Bombycid moths has sometimes been practised by confining newly matured females so that the males attracted could be secured, but I am not aware that it has been made a matter of careful observation and record, or that the source of the attracting secretion has been made out. I have often secured a limited number of male *T. polyphemus*, and of *Platysamia cecropia*, by this method, but a recent experience is, for myself, out of the ordinary, and may be worth reporting.

In the latter part of July, 1893, a fine female *T. polyphemus* emerged in one of my breeding cages. She came from her cocoon in the afternoon, and by night her wings were pretty well expanded. I thought when I went home at five o'clock that her wings were not sufficiently firm for a good cabinet specimen, and so she remained in the cage till next day. In the evening of the following day cage and moth were taken to my home, and mosquito-bar being tacked over the front of the cage the latter was placed in the open window of my bedroom. In the night I was awakened by the fluttering of wings against the window and curtains, and getting up secured the two first males that had appeared. It was then just 1.30 A. M. From this time till daylight the males continued to come, sometimes two or three arriving about the same time, but oftener one at a time. All that appeared were captured, and in the morning I found I had twenty males, most of them nearly or quite new in appearance.

The next night the same story was repeated, the first moths appearing at about half-past one, and the rest scattering along between this and morning. This night I secured twenty-three males.

The third day was rather cool, and the night following was cool and breezy. The female had now laid most of her eggs. No males appeared. I thought no more would come, but concluded to leave the cage in the window a few nights longer.

The fourth night five males appeared, and on the sixth, four were secured. In the former case the first moth appeared at fifteen minutes of one, and in the latter at two o'clock.

On the sixth night no males were secured, and the

female having placed all her eggs on the sides of the cage, it was decided to terminate the experiment.

As a result I had fifty-two males, all attracted to a single female, in a locality in which the species is not more than ordinarily common. All arrived in the latter half of the night, indicating either that the sense of smell in the males is extraordinarily acute, and that they travel long distances to find the female, or else that it is their habit to be abroad only after midnight. I have no very reliable data upon which to base a conclusion on these points. The scent glands of the female are to be looked for on the under side of the abdomen, where such organs have already been discovered in certain smaller members of the same family of moths. The male organs of smell are doubtless the conspicuously branched antennæ.

IS GRANITE EVER METAMORPHIC?

BY C. CALLAWAY, D.SC., F.G.S., WELLINGTON, SALOP,
ENGLAND.

It is not so many years since it was commonly believed that granite was frequently of metamorphic origin. Numerous cases were quoted of a gradual passage between sedimentary strata and granite; and, as it was held to be incredible that a sediment could be produced from granite, it was inferred that the granite was an altered form of the sediment. The present writer shared in the popular belief, and in several papers written on the more ancient of the Archæan rocks of Great Britain, he assumed that the granitic masses called "Dimetian" and "Malvernian" were metamorphosed stratified rocks. But scepticism soon began to creep in. Case after case broke down on examination, until, within the area of the British Islands, he was unable to find a genuine case of a passage between a sediment and a granite. A few examples will here be given.

In North Wales, several cases were alleged. At Twt Hill, in the town of Caernarvon, granite was said to pass into a quartzose conglomerate. The gradations did indeed appear to be perfect in the field, but the microscope proved that the naked eye was not a reliable guide. It was shown that the granite passed into the conglomeration through the intermediate form of arkose, and even the authors of the metamorphic theory voluntarily surrendered it. A second locality was in central Anglesey. Here a band of granite strikes across the island, trending in the same direction as the adjacent sedimentary and schistose rocks. On one side of it lies hälleflinta, passing into schist. The granite has been described as "Dimetian," and the hälleflinta as a younger formation called "Arvonian." The writer has given prolonged attention to these rocks, and has discovered localities where the granite is seen to send veins into the hälleflinta. The granite must, therefore, be of less antiquity than the hälleflinta, and of eruptive origin. In other parts of Anglesey, certain sediments of Ordovician age have been supposed to be here and there converted into granite; but the most recent investigation of these rocks does not confirm this hypothesis.

In England the facts are similar. The schistose and gneissic rocks of the Malvern Hills have been described as metamorphic Cambrian strata. At a later period they were referred to the Laurentian system, being still regarded as altered sediments. The present writer has been studying these rocks for several years, and has described them as exclusively of igneous origin. The oldest varieties are diorites, and into these there have been intruded granites, felsites, dolerites, and other diorites. Subsequently to consolidation, these masses

have been subjected to enormous pressures, which have produced shear-zones, in which the eruptive rocks have been converted into various gneisses and schists. A very good summary of the writer's papers on these rocks has recently (February 9, 1894) been given in *Science* by Prof. J. W. Redway. Some of the conclusions are still under discussion; but the eruptive origin of the diorites and granites has been admitted by all those who have reviewed the work in the field.

The Hebridean gneisses of Scotland have recently been examined by the Geological Survey of Great Britain. The conclusion of the Director-General (Sir A. Geikie) is that "after a most careful search in these rocks, not a vestige have we yet found of any unquestionable sedimentary material." The writer has given some attention to alleged examples of metamorphic granite in Ireland. In County Donegal a great mass of granite rises amidst quartzites, limestones, and schists, and it has been affirmed that there is a gradual passage between the schists and the granite. The writer examined the junction of the two kinds of rock on both sides of the granite mass, and found the clearest proof of igneous intrusion. At some points the granite veins are seen to run into schists, and to branch in the ordinary manner. Elsewhere the granite is in contact with limestone, and has altered it, producing in it an abundance of garnets as well as some lime-augites.

In western Galway there is another alleged case of the passage of sedimentary rocks into granite. These, also, the present writer has examined. He has found clear evidence of breaks between the sediments and the schists into which they were supposed to pass. He has also ascertained that the "metamorphosed conglomerates" adduced in proof of the sedimentary character of the Galway schists are mixtures of schist, granite and diorite, or of two of them. A foliated structure sometimes appearing in the granite was seen to be due to regional pressure, and not to sedimentation.

A third case, occurring south of Wexford, was also investigated. The writer came to the conclusion that the granite of the Carnsore district nowhere passed into crystalline schists, and that the schists were sharply separated from the sedimentaries by faults. It is possible that some of the schists have been formed from igneous rocks, but, if so, they belong to a different period from the Carnsore granite, which shows no signs of foliation.

In adducing these examples the writer infers no conclusion wider than the facts. He does not deny that there may be such a thing as metamorphic granite; he merely points out that certain alleged proofs have broken down on examination. Nevertheless, the results of the most recent work by other geologists have tended to confirm his investigations, and to suggest extreme caution in accepting other supposed cases of a passage between granite and stratified rocks.

One cause of error in the past has been the assumption that a banded structure was always the result of sedimentation. This view is now exploded, and need not be dwelt upon here. It has recently been shown that even rocks with all the appearance of a banded grit may be of igneous origin. The writer has described a very interesting case of this kind in the Malvern Hills. A granitoid diorite is crushed and decomposed. The hornblende passes into chlorite and iron oxide, which are inter-laminated with finely comminuted feldspar. Both in the field and under the microscope the rock has the appearance of a true sediment. Yet it may be traced without a break into the diorite on one side and into a mica-gneiss on the other. In the old days this grit would probably have been regarded as a conclusive proof that the whole series was of sedimentary origin.

THE EMPLOYMENT OF DISEASE-CAUSING MICROBES FOR THE DESTRUCTION OF FIELD MICE, MOLES AND SIMILAR VERMIN.

BY GERALD M'CARTHY, N. C. AGR. EXPT. STATION.

THE loss annually caused by field mice, moles, gophers, hares and other rodents, is in the United States an indefinite quantity, but must in the aggregate amount to several millions of dollars. In California and Colorado the jack-rabbit, *Lepus Californicus*, and sage rabbit, *L. artemisia*, are very serious pests, while in the eastern states *L. sylvaticus*, the cotton tail, and *L. palustris*, the swamp coney, are depredators in grain shocks and growing crops.

The gophers, *Geomys*, and other genera, are very destructive in the grain fields of the arid West. The damage wrought during winter by gnawing mice and hares in the orchards of the eastern states is a matter of no small consequence to fruit growers, and nursery-men and gardeners raise a continuous howl against the ground mole.

The damage caused in Australia by the introduced rabbit is enormous—almost exceeding belief. In Europe the worst pests of the rodent family are the common field mice, *Arvicola arvalis* and *Mus sylvaticus*, called in France *campagnols* and *mulots*, respectively.

How to destroy these vermin on a large scale and over wide areas, without destroying at the same time useful animals, has recently engaged the attention of many European scientists. In the United States the use of poisoned grain, and more recently of carbon bisulphide for the burrowing species, has given the most satisfactory results, but in various countries of the Old World the employment of pathogenic bacteria for this purpose has given a gratifying success.

In a paper recently presented to the French Academy by M. Jean Danyasz, a destructive, spontaneous epidemic among these animals in the Commune of Charny is described in detail, and experiments reported to show that while highly contagious and fatal to all small rodents, it is quite innocuous to cats, dogs, fowls, domestic animals and human beings. The specific bacillus was isolated by the culture method and was subsequently employed on a large scale to destroy the vermin infesting an area of about seventy-five hectares. The whole number of rodents infesting this space was calculated at from 10,000 to 30,000,—*Arvicola arvalis* being in the majority.

The process of infecting the field with the pathogenic germs was substantially as follows: The contents of ten dozen of gelatin culture tubes containing the bacillus were dissolved in fifty litres of water, and in this was soaked about 80,000 cubes of bread of about 1 c.c.m. The bread was then scattered throughout the field, a morsel being placed near every hole showing recent traces of an occupant. The operation occupied twenty persons two hours daily, from four to six p.m., for three consecutive days. The total cost of the treatment amounted to about 3 1/2 francs per hectare, or about thirty cents per acre. Within three days after the distribution of the infectious bread, sick and dying mice were plentiful in the field, and autopsies of several showed the presence of the microbe in their blood. The bread was distributed over the infested fields September 29 *et seq.*, and on October 15 scarcely a living mouse could be found in the infected area, though abundant enough in neighboring non-treated fields. Opening the burrows of the rodents showed their galleries to be filled with dead mice.

This same process was tried in several other departments of the republic, and always with similar success, insomuch that the author concludes that in this microbe

farmers whose fields are infested by gnawing rodents have a simple, inexpensive and certain remedy.

The identification of the bacillus is not given in the paper referred to, but is promised in a future communication to the Academy. The author states that it is very similar to the bacillus of duck cholera, but not identical, nor are ducks or other fowls susceptible to the disease.

SCIENTIFIC WASHINGTON.

THERE are now seven associated scientific societies in Washington, having a combined membership of 1524, comprising 1138 persons. These societies and their membership are as follows:

Anthropological, 205; Biological, 190; Chemical, 102; Entomological, 38; Geographic, 619; Geological, 137; Philosophical, 233. These numbers indicate the active resident membership: there are in addition 472 members, a few honorary, the remainder active, though residing elsewhere.

These organizations include many men eminent in science and in official life. Among officials are Hon. H. A. Herbert, Secretary of the Navy; Hon. J. Sterling Morton, Secretary of Agriculture; Major J. W. Powell, Director United States Geological Survey; T. C. Mendenhall, Superintendent United States Coast and Geodetic Survey; Professors S. P. Langley and G. Brown Goode, Secretary and Assistant Secretary of the Smithsonian Institution; Col. Marshall McDonald, Commissioner of Fisheries; Prof. Simon Newcomb, Superintendent Nautical Almanac; Dr. Frank Baker, Manager National Zoological Park; Prof. W. J. McGee, in charge United States Bureau of Ethnology (who has the unique distinction of being a member of all seven societies); Prof. M. W. Harrington, Superintendent Weather Bureau; Prof. W. T. Harris, Commissioner of Education; Mr. A. R. Spofford, Librarian of Congress; Prof. John R. Proctor, President Civil Service Commission; General A. W. Greely, Chief Signal Officer; Surgeon-General George M. Sternberg; Dr. John S. Billings, of the Army Medical Museum; Dr. C. W. Dabney, Assistant Secretary of Agriculture; Dr. B. E. Fernow, Chief of Division of Forestry, Department of Agriculture; Professors Eastman, Hall and Harkness, of the United States Naval Observatory, and many other prominent officers of the Government.

Congress is represented by Senators Manderson, Vilas, Perkins, Squire, and Wilson, and Representatives Baker, Belknap and Stevens.

From the army and navy are many officers whose names are well known, among them General S. V. Benét, General J. C. Breckinridge, General T. L. Casey, Commodore O. C. Badger, Chief Engineer George W. Melville, Dr. J. Mills Browne, Dr. G. H. Beyer, Dr. N. L. Bates, Captain W. T. Sampson and Captain Rogers Birnie.

Every branch of science is represented in these societies, and among many distinguished names a few may be found that are eminent in more than one sphere of research. Here is Prof. Lester F. Ward, who is not only a noted paleobotanist, but a profound student of sociology, and the author of "Dynamic Sociology," "The Psychic Factors of Civilization" and other works; also that of Mr. W. H. Holmes, who is known not only as a geologist and archaeologist, but also as an artist; and that of Mr. Henry Gannett, chief topographer of the United States Geological Survey and author of numerous sociologic and economic papers, including a recent book entitled "The Building of a Nation."

Among geologists are Professors G. K. Gilbert, S. F. Emmons, Arnold Hague, George F. Becker, J. S. Diller,

and Bailey Willis, son of Nathaniel P. Willis, the poet and littérateur.

Among palæontologists are Dr. W. H. Dall, Dr. C. A. White, Mr. C. D. Walcott and Mr. Robert T. Hill.

Among chemists are Professors F. W. Clarke, H. W. Wiley, R. B. Warder, and C. E. Munroe, Dr. J. M. Toner, Mr. W. F. Hillebrand and Mr. T. M. Chatard.

Biological science is represented in all its branches—botany by Mr. George B. Sudworth, Mr. F. V. Coville, Mr. W. R. Smith, Dr. Erwin F. Smith, Mr. B. T. Gallo-way and Mr. F. H. Knowlton; entomology by Prof. C. V. Riley, Mr. L. O. Howard, Mr. W. H. Ashmead and Mr. George Marx; ichthyology by Prof. Theodore N. Gill, Dr. Tarleton H. Bean, and Mr. Richard Rathbun; ornithology by Mr. Robert Ridgway, Dr. Elliott Coues, and Mr. H. W. Henshaw; mammalogy by Prof. F. A. Lucas, Mr. C. Hart Merriam and Mr. F. W. True.

Professors Cleveland Abbe and F. H. Bigelow, meteorologists, are enrolled, and Messrs. H. M. Wilson and F. H. Newell, whose work in the arid West upon problems of irrigation has given them prominence.

Among anthropologists are Colonel Garrick Mallery, Dr. Robert Fletcher, Prof. O. T. Mason, Mr. James C. Pilling, Mr. Thomas Wilson, Mr. F. H. Cushing, Drs. Cyrus Thomas, J. Owen Dorsey and A. S. Gatschet, Captain J. G. Bourke and Mr. James Mooney.

Outside the sphere of technical science many distinguished names appear in the list of members. Here are the venerable Alexander Melville Bell and his son, Alexander Graham Bell, the inventor of the telephone.

Education is represented by Dr. James C. Welling, President of Columbian University, Prof. W. B. Powell, Superintendent of the Public Schools of Washington, President J. E. Rankin, of Howard University, and President E. M. Gallaudet, of the National College for the Deaf.

Literature and journalism are represented by Mr. Henry Adams, the historian, Mr. George Kennan, Mr. William E. Curtis, Mr. C. S. Noyes, Mr. T. W. Noyes; Mr. S. H. Kauffman, Mr. H. L. West, Mr. H. B. Macfarland, Mr. Harry Godwin, Mr. W. A. Croffut, Mr. E. B. Wight, Mr. Henry Farquhar, Mr. C. R. Dodge, and Mr. Clifford Howard.

Other well-known members are Mr. Gardiner G. Hubbard, Mr. B. H. Warner, Mr. John Tweedale, Dr. Swan M. Burnett, Prof. A. H. Thompson, Prof. Gilbert Thompson, Dr. R. W. Shufeldt, Dr. Cyrus Adler, Rev. Teunis S. Hamlin, Rev. G. M. Searle, Dr. Joseph Pohle, Rev. J. G. Hagen, Dr. A. F. A. King, Dr. L. C. Loomis, Mr. John Joy Edson, Rev. J. Macbride Sterrett, Mr. William B. Taylor, Mr. Edward Clark, Prof. H. L. Hodgkins, Dr. Theobald Smith, Dr. D. E. Salmon, Mr. Henry Ulke, Mr. J. Stanley Brown, Major William H. Webster, Mr. A. B. Johnson, Dr. H. C. Yarrow, Mr. C. J. Bell, Mr. Edwin Willits, Mr. W. A. DeCandry, Mr. J. Ormond Wilson, and Mr. W. B. Chilton.

Among ladies enrolled are Mrs. Caroline H. Dall, Miss Alice Fletcher, Miss Kate Foote, Mrs. J. M. Lander (who will be remembered by old play-goers as Miss Jean Davenport), Dr. Anita Newcomb McGee, Mrs. E. R. Scidmore, Miss Sara A. Scull, Mrs. M. C. Stevenson, Mrs. L. O. Talbott, and Miss Haidee Williamson.

Meetings of the societies are held monthly or semi-monthly from October to May at the Cosmos Club, at Madison Place and I Street, and at each meeting two or more papers are usually read and discussed.

Most significant is the extent of the out-of-town membership of these societies, including some of the best-known scientific men in the country, among them Prof. W. O. Atwater, of Wesleyan University; Dr. F. Bascom, Ohio State University; Dr. J. C. Branner, Leland Stan-

ford University; Prof. T. C. Chamberlin, University of Chicago; President John M. Coulter, Indiana University; Dr. Thomas Craig, Johns Hopkins University; Prof. W. R. Dudley, Leland Stanford University; President Daniel G. Gilman, Johns Hopkins University; Prof. E. L. Greene, University of California; Prof. E. S. Holden, Lick Observatory; Prof. E. S. Morse, Peabody Academy of Science; Prof. H. S. Pritchett, Washington University, St. Louis; Prof. I. C. Russell, University of Michigan; Prof. H. M. Seely, Middlebury College, Vermont; Prof. D. P. Todd, Amherst, Mass.; Prof. Winslow Upton, Brown University, R. I.; Prof. C. R. Van Hise, University of Wisconsin; Prof. George H. Williams, Johns Hopkins University; Prof. H. S. Williams, Yale; Prof. Alex. Ziwet, University of Michigan; Prof. J. E. Whitfield, Philadelphia; Dr. Washington Matthews; Major C. E. Dutton and Mr. Charles Nordhoff.

The constant increase in the number of this class of members is an indication that Washington is rapidly becoming a national centre of scientific thought.

GOLDEN SANDS OF THE PACIFIC COAST.

BY CLARENCE M. BUEL, E.M., ST. PAUL, MINN.

THESE auriferous deposits denominated "Black sands" occur at intervals from Takutat Bay, some 250 miles north of Sitka in Alaska to Santa Cruz Bay, California, and have been worked for many years with primitive appliances, sluice box and pan, the gold being fine flake or flour, less than twenty-five per cent being saved. These deposits already mined, milled and on the dump, ready to work, contain a sufficient quantity of gold to more than pay the national debt, *could it be saved*, but the prospector finding two hundred colors in his pan, little thinks that the color visible to the naked eye is but the 1,000,000th part of a grain, finds it so alluring that he at once rigs up a rough sluice box, and often sends a sample to an assayer who gives him returns from \$5 to \$40 per ton, wonders that he seldom makes more than \$4 per day, though other methods have been pursued in attempting to separate the gold from the sands too numerous to relate. Accompanying the gold is found platinum and nearly all the platinoid metals. Chlorination has been tried without success, and the cyanide process (McArthur-Forrest patent) proved a failure, the reason chiefly being that the magnetic iron of which these deposits are largely composed converts the cyanide of potassium into a ferro-cyanide, and the zinc used in precipitation rendered inert by reason of its speedy oxidation in the humid saline atmosphere to which it must needs be subjected. On the Oregon coast, at the mouth of the Coquille, the camp of a thousand miners a few years since is now reduced to a single miner. There are old beaches miles back from the present beaches, with beds several feet in thickness, rich in gold, inexhaustible in extent, unworked now and awaiting some method by which the precious metal may be extracted. This state of affairs exists at Gold Beach, Port Orford, Yaquina Bay, Peterson's Point, and over one hundred other localities. Yet each year sees its quota of Chinese working in their crude manner and paying a royalty of \$1 per foot for the privilege. The magnetic iron forms nearly 40/100 and is a mixture of the protoxide and sesquioxide of iron, having 72 parts metallic iron to 28 of oxygen. It is quite hard and scratches glass; strongly magnetic, it is the same as the lodestone, excepting that the latter possesses polarity. It is found in nature disseminated through granite, gneiss, mica, slate, syenite, hornblende slate, chlorite slate and limestone, and is suitable for making the finest quality of steel. Zircon is also found, though too small to be noticed except mineralogically.

THE SELF-PURIFICATION OF RIVERS.

BY CHARLES V. CHAPIN, M.D., SUPERINTENDENT OF
HEALTH, PROVIDENCE, R. I.

A GREAT deal has been said and written about the self-purification of rivers, and both the advocates and opponents of the theory that rivers readily purify themselves have taken a very firm stand in the matter. The question, however, is not one which is easily settled. A great many factors must be taken into consideration before we can reach a just conclusion. The question of dilution is an important one. A polluted stream may apparently become purified when in reality there is simply a dilution owing to the addition of pure water either from tributaries or from springs. On the other hand a river may apparently continue without showing any signs of improvement, the improvement being masked by the addition of pollution at various places. It is very seldom that in these discussions this factor has been taken into account and more rarely still that actual measurements have been made, for it is no easy matter to do this. In the first place the amount of water entering the stream between the two points where the tests are made must be approximately known, whether it comes from springs or tributaries. Then the character of this addition must be known, for in most cases the water of tributaries contains very appreciable amounts of pollution.

Another difficulty is the collection of samples. It is evident that if samples are taken from different stations on the same day and hour the sample from the lower station will not by any means necessarily represent the water at the upper station. And even if allowance be made for the flow of the river, it would be extremely dangerous to assume that the water passing the lower station at the calculated time was really the same as that passing the upper station. Yet this method of taking samples at different times should in all cases be followed, though it is by no means the invariable custom.

Another point to be borne in mind is in regard to the chemical analysis of the water. Tests should be made upon the water both before and after filtration through filter paper. In estimating the free ammonia we must take into consideration also the oxidation of albuminoid into the free and the escape of the latter into the air. It is very seldom indeed that all these factors have received due consideration. Perhaps the most careful study of the chemical self-purification of rivers has been made upon the Blackstone by the Massachusetts State Board of Health. A large number of samples were taken with much care during a period of several years, and allowance was made for the addition of natural impurities by tributaries. No allowance was made for the addition of sewage impurities by tributaries, but from a study of the chlorine contents it can fairly be assumed that the amount is small. The first sample was taken just below Worcester, which is the point of pollution, and the last below Millville, twenty-three miles below. The average of all the tests showed a diminution of free ammonia from 1728 to 1299 parts, of albuminoid ammonia from 826 parts to 382, an increase of nitrogen as nitric acid from 218 to 457 and a diminution of total nitrogen from 3000 to 2156. There has evidently then been a very considerable improvement as regards the organic contents of the water, and this notwithstanding a slight addition by tributaries not allowed for. How much of this improvement is due to sedimentation it is impossible to say, but the increase of nitrates shows that it is largely at least due to a true oxidation. Other observers on other rivers have obtained different results, as Percy Frankland from the Thames and Ure, but he does not appear to have taken sufficient account of the addition of

pollution by tributaries. On the whole the work of the Massachusetts Board is the most thorough published, and from it we can fairly assume that in a river moderately polluted there is in the course of a few miles a very considerable destruction of dissolved organic matter by oxidation, as well as loss of solid particles by subsidence.

The aeration of the water of rivers in falling over dams and natural obstructions has been supposed to exert an important influence in purification, but this supposition is not correct; for while dissolved oxygen is necessary for the working of certain purifying changes, an excess of oxygen, introduced by however so efficient aeration, has been shown not to extend such process. Careful experimenting in the artificial aeration of water by the Massachusetts State Board of Health has demonstrated that it has little or no effect in decreasing the organic ingredients, and Professor Leed's experiments upon the water both above and below Niagara Falls, where a natural aeration is carried on on a most stupendous scale, showed that there was no chemical purification.

But by far the most important consideration when river-water is to be used for drinking is the presence of pathogenic micro-organisms. We know that certain diseases may be transmitted by means of the contamination of water with their specific poison, and it is known that the poison consists of bacteria. Cholera and typhoid fever are diseases of this type. If the intestinal discharges from persons suffering from these diseases find their way into a river and thus reach a public water supply the most disastrous consequences may occur to the users of the water. The vital question is, do these bacteria disappear as the result of natural agencies at work in the river, and if so, how long an interval is required to accomplish this result. It is well known that most pathogenic bacteria do not propagate in ordinary river water, but on the other hand tend to die out. But they die slowly and may live for days and perhaps weeks. Investigation alone can show whether in running rivers there are factors which operate more unfavorably than in confined waters. Observations on the bacterial contents of a river are not readily made, some of the difficulties of chemical analysis holding for biological as well, and observers are not all agreed upon results.

Frankland found in the Thames and Ure that there was no apparent diminution in the number of organisms as the river flowed along. Elaborate tests were made on the River Spree at Berlin by Frank. Specimens were taken at fifteen different stations above, below and in the city and subjected to bacteriological examination. It was shown that although sometimes hundreds of thousands of bacteria were added to each centimetre of water flowing through the city the number was in the course of a few miles reduced to 3000 to 8000, about the same as above the city. It is probable that this result was due largely to sedimentation.

In the Isar, thirty-three kilometres below Munich, the point of pollution, the bacteria were reduced from 15,231 to 2378.

The following is the average result of ten tests on the Limmat, which flows out from Lake Zurich, past the city of the same name.

STATIONS.	DISTANCE.	NUMBER OF BACTERIA PER C. C.
Outflow from lake,	0	225
Station 1,	1.86	1,731
Sewer outlet,	2.175	296,670
Station 4,	2.485	12,870
" 5,	2.796	10,892
" 6,	3.417	5,902
" 7,	5.903	4,218
" 8,	6.214	2,346
" 9,	8.078	2,110

It has been inferred by some from these experiments that rivers can be relied upon to purify themselves or free themselves from disease-producing organisms by the natural flow of a few miles. I do not, however, think that this is a safe assumption. The difficulty in conducting such experiments is so great, and the knowledge that we possess of the conditions of life for pathogenic bacteria in running water is so scanty, that we are not justified in considering that water can be thus purified. Moreover there are many observations which show that rivers are not so purified.

Thus at Providence an epidemic of typhoid fever was traced to a very slight pollution of a large and rather rapid stream three and a quarter miles above the intake of the city supply.

The city of Philadelphia suffers continually from a high typhoid death rate, and this is due unquestionably to the pollution of the Schuylkill River by sewage, much of which contamination takes place many miles above the intake.

The Merrimac River is polluted by sewage at many points along its course, especially at the cities of Concord, Nashua, Lowell and Lawrence. Typhoid fever has for many years been exceedingly prevalent at Lowell and Lawrence, which take their water supply from the river, although Lowell is fourteen miles below Nashua and Lawrence nine miles further down than Lowell. Moreover, when Lowell has suffered from an exceptionally severe outbreak, Lawrence has had the same experience soon afterwards. Newburyport is seventeen miles below Lawrence and takes its water from springs, but two years ago, this supply being low, a pipe was extended into the Merrimac, and soon after an epidemic of typhoid occurred. These failures in self-purification are very instructive from the fact that the river flows so many miles without being freed from disease germs, and secondly because the river is very large as compared to the amount of sewage which enters it.

From theoretical and experimental considerations, and still more from the experiences first related, we must believe that a river once infected with disease-producing bacteria undergoes only a moderate degree of self-purification. What there is, is because the bacteria either settle to the bottom or die. Complete subsidence probably cannot take place in a flowing river, and as from one to two weeks are required to destroy the vitality of certain kinds of pathogenic organisms it can be only very rarely that conditions necessary for entire purification are found. As sewage is always likely to contain disease-producing organisms it follows that a river which receives sewage should be considered unfit to serve as a public water supply. Certainly if in rare cases it may be safe so to use it, we are not yet able to predicate the necessary conditions.

LETTERS TO THE EDITOR.

* * * Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The Editor will be glad to publish any queries consonant with the character of the journal.

Palæolithic Pottery.

As bearing upon the discussion about the so-called *hiatus* between palæolithic and neolithic times, Dr. Brinton has made a statement in his "Notes on Anthropology" (*Science*, March 9, 1894), to which I must decidedly demur. He says, "All must now concede that palæolithic man made pottery, which was long denied him." I suppose that Dr. Brinton relies for this statement mainly upon the authority of the Marquis de Nadaillac, in various works,

and especially in his "Manners and Monuments of Prehistoric Peoples," p. 100. But that gentleman is a closet archæologist and not an explorer, and he bases his opinion upon antecedent probability, and not upon personal knowledge, citing certain authorities of at least questionable value. In the single instance in which he makes an assertion upon his own authority he is certainly wrong. After stating that "Evans and Geikie in their turn assert the absence in England of palæolithic pottery, and Sir J. Lubbock energetically maintains this opinion," he adds in a note "But what is the value of categorical assertions of this kind in presence of the fragments of pottery found at different levels in Kent's Hole?" Now, as I have had occasion to say elsewhere, if this statement were correct, it might be regarded as settling the question, for never were investigations conducted more carefully and more scientifically than were those carried on for fourteen years by Mr. Pengelly, at Kent's Hole, near Torquay, on behalf of the British Association. This is what he says in his report made to that body in 1873, p. 213: "The men of the black mould had a great variety of bone instruments; they used spindle-whorls, and made pottery, and smelted and compounded metals. The older men of the cave earth made few bone tools; they used needles and probably stitched skins together; but they had neither spindle-whorls, nor pottery, nor metals." There could not be a plainer assertion than this of the absence of pottery from the more ancient deposits in Kent's Hole.

So, too, Prof. Boyd Dawkins, whose researches in the bone-caves of England are known to men of science the world over, says in "Early Man in Britain," p. 209: "There is no reason to suppose that the cave men used vessels of pottery, since no potsherds have been discovered in any of the refuse-heaps which have been carefully explored in France, Germany, Switzerland and Britain. The round-bottomed vase from the Trou du Frontal, considered by M. Dupont to imply that the art of pottery was known at this time, is of the same fashion as those of the neolithic age from the pile dwellings of Switzerland, and probably belongs to that age. . . . Had the cave men been acquainted with the potter's art, there is every reason to believe that traces of it would be abundant in every refuse-heap, as they were subsequently in those of all pottery-using peoples, a fragment of pottery or of burnt clay being as little liable to destruction as a fragment of bone or of antler."

It is upon these discoveries of M. Dupont that De Nadaillac rests his belief that in Belgium, at any rate, the cave men made a rude pottery, while the mammoth and the cave bear were still their neighbors. But it is a fact that among the fragments of pottery discovered by Dupont in the Belgian caverns were some that had been made upon the potter's wheel; and it is certainly remarkable that "the round-bottomed vase from the Trou du Frontal" was quietly withdrawn from the glass cases of the Brussels Museum ("Matériaux," x., 332; xvi., 124).

Within the past ten years some discoveries made by M. Fraipont, and his co-laborers, in certain Belgian caverns at Spy, Engis and Petit-Modone, have been supposed by some persons to lend confirmation to Dupont's views. But the thorough discussion of these finds by M. Cartailhac in "Matériaux," xxii., 63-78, shows upon how slight a foundation they are based. The most they can be held to establish, if they are proved, is that during the age of the mammoth pottery was invented by one tribe of savage hunters, living in Belgium; that the knowledge of it never spread, and was finally lost, without having been transmitted to the men of the age of the reindeer.

M. Salomon Reinach, in his masterly "Description

Raisonnée du Musée de Saint Germain-en-Laye," p. 157, sums up the present state of opinion in France on this question in this thoroughly impartial fashion: "The knowledge of pottery (of the cave men) is doubtful; at the most it was the privilege of some few tribes. The fragments of pottery discovered in the quaternary beds can almost always have been introduced there through fissures or by the action of burrowing animals;" and in a note, giving a bibliography of authorities, upon this difficult question of quaternary pottery one can always fall back upon later disturbance of the beds, as do MM. de Mortillet and Cartailhac, who deny formally the existence of pottery in the age of the reindeer."

I think these citations are ample to show that all do not concede that palæolithic man made pottery.

HENRY W. HAYNES.

Boston.

Mr. MacDougal and Poisoning from *Cypripedium spectabile*.

In Bulletin No. 9, Minnesota Botanical Studies, are several interesting papers; and Mr. D. T. MacDougal's paper "On the Poisonous Influence of *Cypripedium spectabile* and *Cypripedium pubescens*" is of special interest because there is conclusive evidence that at least one of these plants is poisonous to some people. Both of these species are common in parts of Minnesota and Wisconsin, and I remember at least one case of supposed poisoning from the Large White Lady's Slipper. Some twenty years ago this species was common in rich moist woods in the coulés and ravines near springs and in the marshes of western Wisconsin. Children used to collect this species in large quantities, and on one occasion a young man collected a large quantity of the flowers, followed by a swollen face. It is so long ago, however, and as I could scarcely have been more than ten or eleven years old, I do not remember more than the collecting of the flowers and that his swollen face was attributed to this plant. It may have been from Poison Ivy, which is common in this region, but the person insisted he was poisoned by this Lady's Slipper. Mr. MacDougal gives the following interesting experiment, which leaves no doubt as to the poisonous character of the plant to some persons at least: "The author, while in the field at Twin Lakes, near Minneapolis, September 7, 1893, met with several well grown plants of *C. spectabile*, with newly formed seed pods. A robust specimen was broken off near the base of the stem, and the leaves were brushed lightly across the biceps muscle of the bared left arm. A slight tingling sensation was felt at the time, and fourteen hours later the arm was greatly swollen from the shoulder to the finger tips." He finds two kinds of hairs, one glandular, the other pointed. The poisonous effects may be due to the piercing of the skin by the pointed hair and the consequent action of the acid contents, or the surface irritation by the contents of the glandular hairs. Seventeen other plants found in Minnesota are enumerated which are poisonous to the touch, and some of these are common weeds like Cocklebur (*Xanthium canadense*), Horse Weed or Fleabane (*Erigeron canadense*) and White Spurge (*Euphorbia corollata*). The writer of this note is extremely sensitive to the action of Poisonous Ivy (*Rhus vernix*), but *Primula obconica*, which is said to be poisonous to some people, had no effect nor did it have any effect on several students working in the botanical laboratory on whom the experiment was tried. I know of one person who is systematically poisoned when he picks up wild grass. When questioned he stated that Poison Ivy was not seen by him. This matter of poisoning to the touch by different plants is largely a matter of individuality and condition of the system. Previous to 1886 I could pick and cut Poison Ivy with impunity, but in the

spring of that year I was poisoned, and ever since I have been sensitive to its action. I may state that at the time I was subject to a slight bilious attack. I was perspiring very freely. I am certain that I touched my eyelids and face; had I not done so I would have been free from its effects.

L. H. PAMMEL.

Iowa Agricultural College, Ames, Iowa.

A Miniature Water Lily.

I HAVE been shown Mr. H. B. Ayres's note in the last number of *Science*, in which he credits me with having found *Nymphaea odorata* var. *minor* on the Moose River, near James Bay, in 1885. Though I ascended the Moose River in that year, I neither collected nor saw this plant. In the year 1886, however, in lat. 54, near the head waters of the Severn River, which runs into Hudson Bay, I did collect a *Nymphaea* which I took to be *N. odorata* var. *minor*. Specimens were sent to Dr. Britton, who identified them as *Castalia pygmaea*, Salisb. (*Nymphaea pygmaea* Oit. = *N. tetragona*, Georgi). Dr. Britton wrote me at that time: "The plant may be at once distinguished from the eastern *N. odorata* var. *minor*, by the oblong leaves, sometimes nearly twice as long as broad, with narrow, acutish lobes and the flowers still smaller, with seven to eight rayed stigma." The specimens in the herbarium of this department were then examined, and it was found that specimens collected by Dr. Robt. Bell, in 1879, on the Mesinabic River—a branch of the Moose River—and named *N. odorata* var. *minor*, were also this species.

Mr. Wm. McInnis, of the Geological Survey Department of Canada, reports a small *Nymphaea* as being abundant in some of the small lakes east of the Rainey Lake, almost due north of Red Lake. It seems to me probable that both these and the Red Lake and Turtle Lake plants are *Castalia pygmaea* and not *Nymphaea* (*Castalia*) *odorata* var. *minor*.

JAS. M. MACOUN.

Geological Survey Department, Ottawa.

The Swastika Cross.

THE display of relics in the anthropological building of the Columbian Exposition, collected by Mr. Warren K. Moorehead from a cluster of mounds near Chillicothe, Ohio, contained, among many other very interesting objects, a large number of Swastika crosses made from thin strips of copper. The occurrence of copper ornaments of that shape so perfectly wrought, and in such numbers, occasioned much surprise, and attracted great attention. A communication which I made to the *New York Independent* of Nov. 16, describing these objects, has brought to me two interesting communications from widely separated portions of the globe giving valuable information concerning the wide-spread use of this symbol.

Mr. John Thorgeirson, writing from Bannacks, Montana, tells me that an ancient MS., owned by his grandfather, in which there were many runic characters, represented Thor's hammer as of the form of the Swastika cross. It is interesting to note, also, that before Christianity had wholly subdued the Northmen the sign of the cross and of Thor's hammer, when made before partaking of festive draughts, were sometimes confounded, greatly to the misunderstanding of spectators.

Another communication from Rev. F. H. Chalfant, missionary at Shantung, China, informs me that the same symbol is among the mystic Chinese characters, to wit, "wan" (卐), and is a favorite ornament with the Chinese.

This occurrence of so peculiar a symbol in countries so widely separated as Scandinavia, China, and the Mississippi Valley is certainly suggestive either of an original con-

nection between the races which migrated to those regions, or of early intercommunication between them. But my own information upon the subject is too scanty for me to discuss it further. G. FREDERICK WRIGHT.
Oberlin, O.

Nature Study in the Schools.

IN *Science* of March 2 an article on "Botany in the Schools" calls attention to a subject of interest to all teachers. "Nature Study," it may be assumed, has come to stay. It is too important a factor in education to be left out, even though its first introduction into the schools be accompanied with mistakes and inefficiency. This being granted, it is very reasonable to say, as does the writer of the article mentioned, that for the best results "a competent specialist should be put in charge of the work who could instruct the teachers, just as the specialist does in music and drawing." Nothing less than this, certainly, should be demanded of normal schools and large city schools having their own training departments. Teachers adapted to the work and thoroughly equipped for it should be put in charge of the training for science-teaching in the grades for the relief of the academic science teachers, whose regular work follows advanced methods, and for the more efficient application of the principles which govern elementary teaching. The State Normal School of Michigan sends out nearly two hundred graduates a year, many of them from the longer courses of study. The training schools of the large cities send out many more, and there is thus sent into the schools of the State each year a large body of teachers who know the meaning and the methods of "Nature Study."

But in any state, the large city schools form only a small portion of the aggregate. There are many schools in which the question of economy must regulate matters, and many schools which are not large enough to require the services of a special teacher. Shall these schools, then, "drop the subject altogether from the curriculum?" We answer decidedly not. Intelligent teachers, by reading and by study and use of material, should be able to fit themselves to do good work in this as well as in other lines. There are plenty of recent publications for their benefit, some of more, others of less, value. There are occasionally helpful lectures, and sometimes regular instruction at teachers' institutes. Every year the helps grow more numerous and are within easier reach. Current educational literature on this subject is not yet so abundant as it ought to be, but the demand will bring the supply. The educational journals have much that can be utilized, and there is one publication which is devoted to this work exclusively. This is *The Field and School Naturalist*, published at Minneapolis, which has absorbed *The Naturalist Teacher*, the modest little monthly started a few years ago by Professor McLouth, special science teacher in the schools of Muskegon, Mich. There may be other publications of similar character; certainly there soon will be others in the field, for the demand is imperative. With such helps the question of "Nature Study" should not be a question of alternatives, but rather one of doing in each school the very best the conditions will allow. LUCY A. OSBAND.

Michigan State Normal School.

A Brilliant Aurora.

AN aurora of unusual brilliancy and splendor was observed at Madison, Wis., on the evening of Feb. 23. A somewhat less notable display was seen on the night of the 22nd, but, so far as noted, it consisted only of the usual luminous arch, surmounted by long and rather bril-

liant streamers, which were white in the central portion of the arch and rosy red at the eastern and western extremities.

The display on the evening of the 23rd, as seen shortly before nine o'clock, consisted of a very brilliant arch, resting on a dense dark one, while a second dark arch was visible about three degrees below the upper one. The lower arch was not, at first, surmounted by a luminous portion. But few streamers were visible at this time. Stars were plainly seen in the space between the two arches, but not through the upper arch. In a few minutes the lower arch became somewhat luminous, and the dark portion of the upper arch became lighter.

At nine o'clock, at the eastern limb of the upper arch, a series of brilliantly colored streamers began to shoot up with great rapidity. The streamers were broad rather than long, and they had a swift westward motion. Nearly all were of several colors—red, yellow, green and white—in well marked, not very wide, bands. These streamers quickly assumed the appearance of swaying flags or curtains, and rapidly traversed the arch, moving toward the west. They seemed to occupy the space between the arch and the observer, and to absorb the arch as they advanced. Just before the front of the luminous folds reached the highest point of the arch, the latter was seen bending swiftly down in a double curve to about the position of the lower arch spoken of, but which was not then visible, and merging in the pendulous folds of the advancing, swaying curtains.

When the western limb was reached, brilliant streamers of white and crimson shot up to the zenith from both extremities of the arch with the swiftness of fierce flames but with only a slight swaying motion. The curtain-like folds had disappeared. The time occupied in the passage of the phenomena described was less than fifteen minutes. How much longer the display lasted and what was its character was not noted.

The magnetic disturbance was very considerable. After the brilliant portion of the display was over a compass was carefully adjusted and the deflection of the needle noted. The amount of the deflection at the end of fifteen minutes was $3^{\circ}, 58'$ to the west.

Although the movement of the needle was rapid,—most of the deflection occurred during the first five minutes,—the motion could not be perceived by the eye.

G. E. CULVER.

Madison, Wis.

The Durability of the Poisonous Property of Poison Ivy, *Rhus Radicans* L. (*R. Toxicodendron* L.).

A RECENT experience indicates that the poisonous principle of the above named plant is lasting.

In the botanical museum of Ohio State University are some stems of Poison Ivy that were deposited there not less than three years ago.

About ten days ago I noticed that they were infested with borers—the larva of some beetle. Desiring to study the beetle, the stems were broken a few times so that they would go into a covered glass jar. They are found to be bored through many times, so that they broke easily, and at every breaking the powder from the borings flew freely. I had no fears of being poisoned, but about 3.00 A.M. the next morning I was awakened by an itching between my fingers as if poisoned. Later development proved that it was poison, and I can account for it in no other way than that it came from the Poison Ivy. The burning was abated somewhat by the application of olive or sweet oil but lasted for several days. The epidermis is now coming off the affected part exactly as when having been poisoned with *Rhus venenata* D. C. E. E. BOGUE.

Columbus, O., Feb. 12, 1894.

A New Dicotyline Mammal from the Kansas Pliocene.

THE genus *Platygonus* was described in 1852 by Dr. John L. Leconte, from various fragmentary remains obtained at Galena, Ill. Additional species have since been described by Marsh based upon the still more uncertain evidence offered by the teeth alone. The genus has thus had a very doubtful existence, or has been merged into *Dicotyles*. The recent acquisition by the University of Kansas of several skeletons of a species, which, from the comparison of Leconte's figures, I believe belongs here, enables me to give for the first time satisfactory generic characters. This species, which may be known as *P. leptorhinus* Will., is of about the same size as the type, *P. compressus* Lec., from which it is at once distinguishable by the angle of the jaws, which is shaped as in *Dicotyles*, though not at all inflected. From *P. striatus* Marsh, from the Pliocene of Nebraska, the absence of striation of the second premolar tooth (upon which the species was based) will separate it. A figure of the restored skeleton, with a full description, will shortly be given. For the present, the following characters will be of interest: The dentition is like that of *Dicotyles*, except that the incisors are much smaller, and the third lower one is wholly wanting. The molars show a partial confluence of the cusps, but the difference from *Dicotyles* in this respect is not striking. The most remarkable character which the genus shows is the entire absence of the outer toes on both hind and fore feet. They are represented by short splints, which do not reach to the middle of the conjoined metapodials. There are other characteristic differences in the carpus and tarsus, which will be best shown by the aid of figures. The animals were decidedly stouter in form than the living peccaries and stood about thirty inches in height. The last premolar of the milk series had three series of cusps.

S. W. WILLISTON.

Lawrence, Kansas.

BOOK-REVIEWS.

Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus. Herausgegeben von Prof. Dr. G. HELLMANN.

No. 1. *L. Reynman, Wetterbuechlein. Von wahrer Erkenntniss des Wetters*, 1510. Facsimiledruck mit einer Einleitung. Berlin, A. Ascher & Co., 1893, 4to, 42, 14 p. 6 marks (\$1.50).

No. 2. *Blaise Pascal. Récit de la Grande Expérience de l'Equilibre des Liqueurs.* Paris, 1648. Facsimiledruck mit einer Einleitung. Berlin, A. Ascher & Co., 1893, 4to, 10, 20 p. 3 marks (75c.).

IN view of the growing interest that is being shown those infant twin sisters of astronomy—meteorology and terrestrial magnetism—it may not be amiss to call the attention of the readers of *Science* to the above-named series of excellent reprints in facsimile of rare old books and charts that have been epoch-making in the subjects named. Additional importance is to be attached to these reprints in that they are edited by a scholar whose keen critical ability and power for careful, painstaking research have put him in the front rank of the meteorologists and bibliographers of the day.

With the coöperation of the German Meteorological Society and its Berlin branch, the above two numbers have been issued and others promised, such as Luke Howard's "On the Modifications of Clouds, 1803," in which we have the first attempted classification of cloud formations; "Halley's Isogonic Chart of 1700"—the first of the kind; "Humboldt's Isotherms, 1817"—the earliest drawn; and others. As the chief object in view is to

make these classic works, the originals of which are well-nigh unobtainable and very expensive, accessible to every one interested, they are published at the low price named above. Professor Hellman and his coöperators have thus earned for themselves the highest praise and deserve the heartiest coöperation.

No. 1, a most elegant volume, is a facsimile reprint (preceded by a careful and critical discussion by Professor Hellmann) of the oldest meteorological book printed in German. It may, thus, apparently, have more of a local interest. The fact, however, that it ran through seventeen editions in thirty-four years, the earliest being in 1505, of which no trace can now be found, and that it was almost literally translated in "The Boke of Knowledge of Thynges Vnknown, apperteyning to Astronomy, with certain necessarye Rules," published in London in 1585, already enhances the interest in the book. It was besides incorporated in many other works. It was the first attempt at emancipation from the astrological superstitions of the day. In their stead the author strove to substitute simple rules (many in rhyme) based upon natural laws and phenomena. The book thus possesses an interest not only to the professional meteorologist, but also to the bibliographer, the historian, the student of folk-lore, in fact, to all who are interested in the gradual growth of the human mind and in the throwing off of the shackles imposed by the Middle Ages. Of the seventeen editions, Professor Hellmann, through correspondence with one hundred and fifteen libraries, could barely trace more than three dozen copies. The reprint has been made from the second edition of 1510, the only copy of which being in the possession of Professor Hellmann. Of Reynman little could be learned except that he lived in classic Nuremberg, about 1520, and was thus a contemporary of such illustrious men as Georg Hartmann, Albrecht Dürer, and a host of eminent scientists. In writing his book he drew largely upon a large astrological treatise by Guido Bonatti, an Italian astrologer of the thirteenth century, which was published in 1491, and upon "Oposculum repertorii prognosticum in mutationes æris, 1485," by Firmin de Belleval, a Frenchman, otherwise unknown.

No. 2. This volume will surely interest every scientist. It is the reprint of a work of the greatest rarity, as but three copies, two in Paris and one in Breslau, could be found, the one in Breslau being used in the reproduction. In this volume is given the first experimental proof that the pressure of atmospheric air is the cause of the rising of mercury (or any other liquid) in an inverted tube previously exhausted of air and placed in a trough of mercury—the memorable experiment of Torricelli (or rather one of his pupils), in 1643. Up to the time of the publication of this interesting tract, the universal belief was that the cause was to be sought in nature's *horror vacui*. The experiment was most carefully and scrupulously carried out by Perier, a brother-in-law of Pascal. The first eight pages of the facsimile reprint form the letter of instructions sent to Perier by Pascal, Nov. 15, 1647. On Sept. 22, 1648, Pascal received the happy news from Perier of the successful outcome of the experiments. (See p. 17-20). Perier filled two tubes with mercury and saw that their readings agreed at Clermont. He then emptied one and carried it to the top of the Puy de Dome (3550 feet above Clermont) and after filling it again with mercury, found the reading less. After repeating the experiment at a station half-way down, he descended to Clermont and again filled his tube, but now found that it read the same as the one previously left there. Hence, ascent in the air or decrease in height of superincumbent atmosphere meant a fall in the barometric reading, or decrease in pressure. The conclusion was at once evident

that the cause was to be ascribed to the atmosphere. Immediately upon receiving the great news, Pascal hastily drew up a tract and gave to the world the knowledge of the great secret. It is the reproduction of this herald of the great discovery that Professor Hellmann has given us. It was never again re-published, but was incorporated almost unaltered in the "*Traitez de l'Equilibre des Liqueurs*," etc., published in 1663 by Perier, one year after Pascal's death. Hence it is usually believed that the "*Traitez*" gave us the first account.

As is well known, it is believed by many writers that Descartes had suggested these experiments to Pascal, and, in fact, he made that claim in two letters of 1649 to Carcavi. Pascal, as he expressly states in his "*Récit*," believed in a "horror vacui" up to the time of the successful execution of Perier's experiments, nor did he ever deny Descartes's statements. After weighing all the evidence carefully, Professor Hellmann believes he has to side with Mr. Mourisson, who in his recent work¹ declared against Pascal. Whatever may be the truth, the fact remains that Pascal first gave this important discovery to the world, that no little credit must be given Perier for the scrupulous care (He even surrounded himself with witnesses, so that "none could deny") with which he conducted the experiments, and that Professor Hellmann has certainly earned the praise of the whole scientific world in putting at the command of every one such a beautifully executed copy.

Essais d'Or et d'Argent. Par H. GAUTIER. Paris, Gauthier-Villars et Fils. 203 p., 1893.

Choix et Usage des Objectifs Photographiques. Par E. WALLÉN. Paris, Gauthier-Villars et Fils, Quai des Grands-Augustins, 196 p., 1893, Broché, 2 fr. 50, Cartonné, 3 fr.

THE first of these works relates to the preparation and refining of the precious metals, and to their monetary and other alloys. In the preliminary part the author gives a rapid review of the chemical and physical properties of the precious metals and of those metals with which these are frequently alloyed. The principal alloys used in coinage and in jewelry are described, together with the legal control exercised upon them. It is very instructive to learn how closely this official circumspection is carried on in France, and we are forced to regard the looseness current in America with much dissatisfaction. The second part of the book is devoted to the purely practical side of the question, describing methods of refining and of assaying, as well as of analysis by the wet method.

E. Wallén has aimed to make his "Choice and Use of Photographic Objectives" essentially a practical discussion which shall act as a guide to the professional and amateur photographer alike, assisting them both in the choice of their lenses and giving an insight into the requisites of a successful picture. The book is rather more than its title indicates, for, without being abstrusely scientific, it leads one to an excellent theoretical as well as practical knowledge of the photographic apparatus.

Some Salient Points in the Science of the Earth. By Sir J. WILLIAM DAWSON, C.M.G., LL.D., F.R.S., F.G.S., etc. New York, Harper and Brothers. Illustrated, 469 p., 1894, \$2.

A PUPIL of Jameson, a friend and co-worker with Murchison, Sedgwick, Phillips, Logan, Gray, Lyell, and, indeed, with all those historians of the earth's past who have done so much to elevate mankind and to bring him to a sense of his Creator's greatness, Sir J. William Dawson needs no introduction to an English-speaking audience. Always exhibiting a true Christianity and retaining in his most specialized researches a wonderful

conception of the great truths to be learned, Dawson has endeared himself to many students of life as well as to those who have devoted themselves to the details of geology. "*The Earth and Man*," "*The Origin of the World*," "*Science in Bible Lands*," are found in every library, and his many purely scientific discussions have been valued aids in all geological and palaeontological study. "The present work (we quote the preface) contains much that is new and much in correction and amplification of that which is old; and is intended as a closing deliverance on some of the more important questions of geology, on the part of a veteran worker, conversant in his younger days with those giants of the last generation, who, in the heroic age of geological science, piled up the mountains on which it is now the privilege of their successors to stand." In the rush of modern thought, in the *fin de siècle* annihilation of all that has been laboriously erected by our teachers, we are too often liable to forget that these edifices have a foundation which it will profit us to study. In the narrowness of our progress we see only an architecture incompatible, we believe, with the conditions of our greater knowledge, and hence we reject the same to build for ourselves higher structures, may be, but too often with a sacrifice of solidity, to brilliancy and originality of design. It is, then, exceedingly wholesome to take up such a work as the present and to be reminded that there are some, with an experience that few of us can hope to attain, who still cling to the fundamental theories with all the vigor of youth, and who remain undisturbed by the gyrations of modern scientific philosophers. In this "closing deliverance" by Sir William we find a series of chapters each gracefully dedicated to one of those whose labor and life have been given in corresponding research. The subjects discussed are indicated in the title, being those great problems which have presented themselves from the dawn of our extended understanding of the world's history; the process of world making, the first life, the nature of the geological record, the genesis and succession of the earth's fauna and flora, the cause of climatal change, the great ice age and pre-historic man—these are a few of the "Salient Points" which will interest all, whether scientists or laymen in the perusal of this charming work.

Conférences Publiques sur la Photographie. Organisées par LE DIRECTEUR DU CONSERVATOIRE NATIONALE DES ARTS ET METIERS. Paris, Gauthier-Villars et Fils. 545 p., avec 198 figures et 9 planches, 1893. 7 fr. 50c.

THE above unique work embraces nineteen lectures on Photography organized by the eminent Colonel Laussedat, Directeur du Conservatoire des Arts et Metiers, and delivered at that institution during the years 1891-92. Each lecture or conférence constitutes a monograph in its particular subject and in every case has been written by a specialist and originator in that subject. The lectures are here reprinted in the order of their delivery, and though a text-book graded arrangement is not possible the work as a whole is a complete and most valuable treatise on both theoretical and technical photography. Photography is essentially a French science, an art of French invention and in France is carried to its greatest perfection. In fact, nowhere else has it been made, or rather acknowledged to be, so truly a science or so worthy of scientific study and experiment. The contrast is particularly marked when comparing photographic literature of our own country, for instance, with the literature of the same subject in France. Of the many admirable works there recently published none will be likely to find more pleased readers than will this present volume of conférences. It is impossible even to attempt a synopsis of the many subjects treated, but the titles of a part at

¹"Pascal: Physicien et Philosophe, etc." Paris, 1888.

least will give an idea as to the scope of the work. The first lecture by M. A. Davaune is a charming historical discourse on the invention and application of Photography from Daguerre and Niepce to the present day.

Chronophotography, the study of moving bodies, is discussed by M. G. Demyen; Photography in Colors, by Prof. G. Lippmann, of the Faculty of Science of Paris; Astronomical Photography, by Prof. J. Jaussen, Director of the Astronomical Observatory of Meudon; and Photographic Chemistry by M. C. Fabre. To enumerate rapidly the titles of other lectures we have: Medical Photography, Military Photography and Photocartography, Photogravure and Photochromography, the Photographic Objective, Photographic Processes, the Photography of Natural Phenomena, Iconometry and Metrophotography (sciences but little understood in this country but of the greatest importance), Microphotography, the Production of Panoramas, etc., etc.

The book is printed on heavy paper, and the typographic work is in excellent style. The illustrations in most cases are reproductions of photographs and while illustrating the text are in themselves works of art, adding a further charm to the volume.

NOTES AND NEWS.

THE impetus recently given to nature-study in the secondary schools has led to a demand for the more thorough preparation of teachers in the essentials of botany and zoölogy. Teachers cannot get special training in these branches during the college year, because it coincides with their teaching year. In the past their oppor-

tunities for getting it during summer have been limited, on account of the lack of summer schools. To meet this demand the New Hampshire College, coöperating with Superintendent Gowing, of the State Department of Public Instruction, will institute next July a summer school of biology, especially adapted to the needs of teachers in the secondary schools. The instruction in botany will be given by Principal Charles H. Clark, A.M., of Sanborn Seminary, Kingston, N. H.; and in zoölogy by Prof. Clarence M. Weed, D.Sc., of the college. Supplementary lectures will also be delivered by President Chas. S. Murkland, Ph.D., and Superintendent Fred Gowing, of Concord. The school will open Thursday, July 5, and continue until Saturday, Aug. 4. It will be held in the laboratories and class rooms of Thompson Hall, students being granted free use of the library, microscopes, aquaria, collections, and other facilities. The laboratory instruction will be supplemented by work in the field and class-room, and by informal discussions of such topics as are likely to prove useful for illustrative purposes in nature-study in the lower schools. The course of study will cover the line of work in botany and zoölogy recommended in the recent report of the Committee on Secondary School Studies, appointed by the National Educational Association for adoption by the secondary schools. In addition, there will be offered, to such teachers as may desire it, an opportunity of taking a special course in microscopical technique under Principal Clark, or in elementary entomology under Professor Weed. The situation of the college is peculiarly favorable to the study of natural history. Plants and animals inhabiting a great variety of land surface, as well as fresh, brackish, and salt water, are easily accessible.

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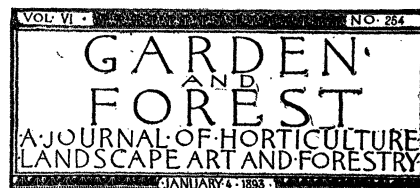
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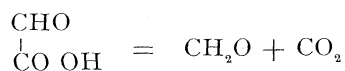
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—At the end of the article on "The Synthetical Powers of Micro-Organisms, I.," in *Science*, Jan. 19, 1894, the equation should read:



—The archaeological researches in the southern part of the republic of Costa Rica, which are now conducted by Enrique Pittier, director of the Physico-geographic Institute at San José, in behalf of the government, have been fruitful in results. His explorations in the Terraba and Boruca portions of the Pacific slope were continued during several seasons and disclosed the fact that the Terraba Indians are not individuals of a homogeneous race, but a medley of several Costa Rican tribes gathered up and settled on the tracts which they now inhabit, during the course of the eighteenth century, by Franciscan missionaries. Among this assemblage of tribes the Terbis or Tervis, who formerly had their home on the northern coast, were prominent, and hence the whole colony of tribal remnants were comprehensively called Terbis or Terrabas. The dialect of the Terrabas was adopted by the rest of the colony Indians. In fact it does not differ greatly from the language of the Bribris and other tribes still extant on the Atlantic side of the Costa Rican cordillera. Another people cognate to the Terraba are the Boruca or Brunka, now living three

leagues south of the above. On their trading expeditions they sometimes visit San José, the capital, and from their homes they reach it in eleven days. They are not communicative concerning their own vernacular, and H. Pittier experienced considerable difficulty in getting collections of Boruca terms and phraseology. In appearance they differ from the Terrabas and are of purer and more homogeneous extraction, as may be readily guessed from what was said previously about the formation of the Terraba settlements.

—The executive committee of the Association of Official Agricultural Chemists has decided to call the annual meeting of the Association for August 23, 24 and 25, 1894. The meetings will be held in the lecture room of the National Museum at Washington, beginning at ten o'clock on Thursday, August 23. The reporters for the meeting are as follows: Phosphoric acid, B. W. Kilgore, Raleigh, N. C.; Nitrogen, J. M. Bartlett, Orono, Me.; Potash, H. J. Wheeler, Kingston, R. I.; Soils and ash, A. M. Peter, Lexington, Ky.; Dairy products, E. H. Farrington, Champaign, Ill.; Foods and feeding stuffs, H. J. Patterson, College Park, Md.; Fermented liquors, Geo. F. Colby, Berkeley, Cal.; Sugar, G. L. Spencer, Washington, D. C. The coöperation of European chemists has been invited in the analytical work, and several acceptances of the invitation have been received. It is urged upon all members who have communications to make to the Association to bring them properly prepared and ready for printing. Much delay has arisen heretofore in securing the manuscript promptly from the reporters and others presenting papers. The speedy publication of the proceedings will be greatly facilitated by bringing everything properly prepared.

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KARYOKINETIC FIGURES IN MAMMALIAN TISSUES.—Since the publication of my Preliminary Notice in *Science* for Dec. 1, 1893, many parties have written me asking for permanent preparations showing mitosis. To these parties I have sent slides, and I now offer to all who desire them slides showing mitotic figures in nuclei of embryo kitten. A good immersion objective is necessary to make out the figures satisfactorily. Send 60 cents in stamps. If the slide is not satisfactory, return it, and I will return the money. I do not care to exchange slides. Frank S. Aby, State University, Iowa City, Iowa.

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